

AD-752 637

TENTS AND SHELTERS

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Army Test and Evaluation Command
Aberdeen Proving Ground, Maryland

27 November 1972

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UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

| | | | |
|--|--|--|-----------------------|
| 1. ORIGINATING ACTIVITY (Corporate author) United States Army Infantry Board Fort Benning, Georgia 31905 | | 2a. REPORT SECURITY CLASSIFICATION Unclassified | |
| | | 2b. GROUP NA | |
| 3. REPORT TITLE U.S. Army Test and Evaluation Command Expanded Service Test - System Test Operations Procedures Tents and Shelters | | | |
| 4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Final | | | |
| 5. AUTHOR(S) (First name, middle initial, last name) Ray Rush | | | |
| 6. REPORT DATE 27 November 1972 | | 7a. TOTAL NO. OF PAGES 12 | 7b. NO. OF REFS 14 |
| 8a. CONTRACT OR GRANT NO. c. PROJECT NO. d. AMCR 310-6 | | 9a. ORIGINATOR'S REPORT NUMBER(S) TOP 10-3-175 | |
| | | 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) | |
| 10. DISTRIBUTION STATEMENT Approved for public release; distribution unlimited. | | | |
| 11. SUPPLEMENTARY NOTES | | 12. SPONSORING MILITARY ACTIVITY Headquarters US Army Test and Evaluation Command Aberdeen Proving Ground, MD 21005 | |
| 13. ABSTRACT Describes methods and techniques for determining if a candidate tent or shelter meets the criteria stated in appropriate requirements documentation and is suitable for US Army use. Subtests address preoperational inspection of physical characteristics, safety, test personnel training, functional suitability, ease of handling, maintenance, transportability, portability, human factors engineering, and value analysis. Testing will be conducted under simulated tactical conditions or conditions similar to those expected in the areas of intended operational use. | | | |

AD 752 637

DD FORM 1473

REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

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14

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| 14 KEY WORDS | LINK A | | LINK B | | LINK C | |
|---|--------|----|--------|----|--------|----|
| | ROLE | WT | ROLE | WT | ROLE | WT |
| Tent Shelter Personal Equipment Protective Cover | | | | | | |

15

UNCLASSIFIED
Security Classification

**U. S. ARMY TEST AND EVALUATION COMMAND
EXPANDED SERVICE TEST - SYSTEM TEST OPERATIONS PROCEDURES**

AMSTE-RP-109

*Test Operations Procedure 10-3-175

27 November 1972

TENTS AND SHELTERS

| Section I. GENERAL | <u>Paragraph</u> | <u>Page</u> |
|---|------------------|-------------|
| Purpose and Scope | 1 | 1 |
| Background | 2 | 2 |
| Equipment and Facilities | 3 | 2 |
| II. TEST PROCEDURES | | |
| Supporting Tests | 4 | 3 |
| III. SUPPLEMENTARY INSTRUCTIONS | | |
| Preoperational Inspection and Physical Characteristics | 5 | 5 |
| Safety | 6 | 5 |
| Personnel Training | 7 | 5 |
| Functional Stability | 8 | 6 |
| Ease of Handling | 9 | 9 |
| Security from Detection | 10 | 11 |
| APPENDIX. REFERENCES | | 12 |

AD 752637

**SECTION I
GENERAL**

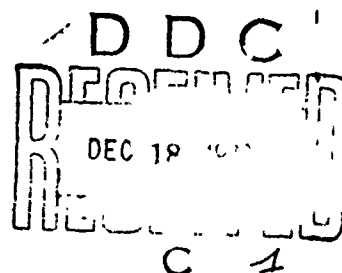
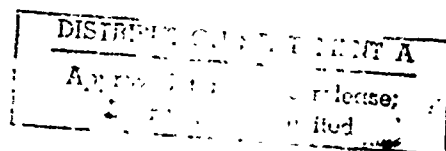
1. Purpose and Scope.

a. This Test Operations Procedure (TOP) is a guide to assist in the preparation of a plan to support Expanded Service Testing (EST) of tents and shelters. It describes methods and techniques for determining if a test item meets the criteria established in appropriate requirements documents and is suitable for use by the US Army.

b. This procedure addresses a preoperational inspection to determine the physical characteristics and serviceability of the test item, a series of appropriate tests designed to examine the operational and functional performance characteristics, and an examination of the safety, human factors, and value engineering aspects of the test item. Testing will be conducted under simulated tactical conditions or conditions similar to those expected in the areas of intended operational use of the test item.

*This TOP supersedes MTP 10-3-175, 22 February 1971.

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27 November 1972

2. Background.

a. New types of military tents and shelters are constantly being developed and existing tentage is being improved or modified to support the requirements of new tactical and logistical concepts of modern warfare. New technological designs and materials contribute to changes designed to afford the soldier in the field optimum working comfort commensurate with his tactical environment.

b. The EST offers a vehicle for testing candidate tents and shelters in a user environment with test soldiers representative of those who will employ the item in the field role for which it was designed.

3. Equipment and Facilities.

a. Equipment.

- (1) Test item.
- (2) Control item (if used).
- (3) Weighing scales.
- (4) Measuring tape.
- (5) Photographic equipment.
- (6) Devices to measure and record wind speed and direction.
- (7) Thermometers.
- (8) Stopwatches.
- (9) Communications equipment.
- (10) Safety and first aid equipment.
- (11) Tactical vehicles, air and ground.
- (12) Other items specified in referenced documents.

b. Facilities.

- (1) Area suitable for tactical exercises.
- (2) Classroom, office, and storage space.

SECTION II TEST PROCEDURES

4. Supporting Tests.

a. The supporting tests are designed with sufficient flexibility to allow opportunities for tailoring a test plan to the precise characteristics and stated requirements of a specific item, and to the state-of-the-art and testing methodology at the time and place of testing.

b. Adequate data should be collected to support valid conclusions. These objectives may be constrained by limited numbers of test or control items; limited time for testing; or shortages of funds, manpower, or support facilities. To identify the best means of securing meaningful data within the limitations imposed, the test officer should remain in close liaison with available statistical and human factors personnel. The statistician can assist in selecting an experimental design or pattern and helping to fix such requirements as the number of test personnel needed, items to be tested, and repetitions needed to support statistically sound judgments in particular operations. Human factors representatives may provide guidance in developing and presenting questionnaires, interview techniques, and other human factors input required during the test. Statistical guidance related to the selection of appropriate samples and levels of confidence may be found in TOP 3-1-002, Confidence Intervals and Sample Size.

c. A test item will normally be compared with a control item during most expanded service testing. The control item should be selected from the standard inventory and possess as many related characteristics to the test item as possible. To add to the credibility of comparative testing, the control item should be new or near-new and subjected to the same care and maintenance as the test item throughout the conduct of the test.

d. A log book should be maintained as a chronological record of observations, data, times, comparisons, weather, and other pertinent events. An accurate compilation will expedite the collation process required to support test findings. Photography (still and motion), charts, and/or graphs should be used to portray or substantiate results when appropriate.

e. Common Service TOPs, the tests defined in Section III, and other published documents to be considered in formulating an expanded service test plan are listed below. Additional reference material is listed in the Appendix.

27 November 1972

| <u>TEST SUBJECT TITLE</u> | <u>PUBLICATION NO.</u> |
|---|-----------------------------|
| (1) Preoperational Inspection and Physical Characteristics (refer to para 5) | 10-3-500 |
| (2) Safety (refer to para 6) | 10-3-507 |
| (3) Personnel Training (refer to para 7) | |
| (4) Photographic Coverage | 7-3-519 |
| (5) Functional Suitability (refer to para 8) | |
| (6) Ease of Handling (refer to para 9) | |
| (7) Desert Environmental Testing of General Supplies and Equipment | 10-4-001 |
| (8) Tropic Environmental Testing of General Supplies and Equipment | 10-4-003 |
| (9) Man Portability/Transportability | 10-3-506 |
| (10) Airdrop Operations | 7-3-511 and 7-3-512 |
| (11) Air Portability, Internal | 7-3-515 |
| (12) Air Portability, External | 7-3-516 |
| (13) Security from Detection (refer to para 10) | 1-3-515 |
| (14) Durability and Reliability | 10-3-502 |
| (15) Maintenance Evaluation | 10-3-504 and TECR 705-15 |
| (16) Human Factors Evaluation | 10-3-505 |
| (17) Value Analysis | TECR 700-1 |

SECTION III
SUPPLEMENTARY INSTRUCTIONS

5. Preoperational Inspection and Physical Characteristics.

a. The applicable procedures of TOP 10-3-500 should be applied to (1) verify the completeness of the test item, (2) compare test item characteristics with those specified as criteria in applicable needs documents, and (3) determine that the test equipment is in serviceable condition and suitable for further testing.

b. In addition to arriving at a final judgment of test results, it is important that a tester identify the time and place of any failure which occurs. Defects that originate prior to the test item's arrival at the test site must be detected and recorded during this pre-functional operation phase to ensure an accurate accounting of failures found during subsequent tests. As an example, a tent might arrive at a test site poorly sewn or stitched, which would be a failure of quality assurance. Resultant leakage should therefore be attributed to the production inadequacy, not to a design or material failure.

6. Safety.

a. The applicable procedures of TOP 10-3-507 should be performed to (1) determine the effectiveness of test item safety features, and (2) confirm the safety provisions established for the conduct of testing.

b. Safety must be considered throughout the course of the EST and, to the extent possible, should be evaluated concurrently with, or as adjunct to other subtests. In order to be safe for troop use, an item must be free of conditions or features that may cause personal injury or inadvertent property damage to its user. The area of concern applies to the real and potential hazards of the test item and to its relation to any combination of items with which it may be used.

c. Attention is directed to the requirements to verify safety limits and to compile data relevant to the safety confirmation required by TECOM Reg 385-6, Verification of Safety During Testing. Note should be taken of any instance where safety restrictions unduly influence test procedures.

7. Personnel Training.

a. The appropriate measures described in TOP 10-3-501 should be performed to determine (1) the type and extent of instruction required

27 November 1972

to train soldiers to use the test item, (2) the adequacy of accompanying programs of instruction, and (3) if the training requirements meet the criteria of the applicable requirements documents.

b. During this period of training, all test personnel should become familiar with:

- (1) The characteristics of the test and control items.
- (2) The conduct, procedures, and objectives of expanded service testing.
- (3) Individual assignments and responsibilities.

c. To minimize bias and achieve credibility during tests that compare the candidate item with an older, more familiar model, it is essential that test participants become equally familiar with test and control items. Training should be oriented toward producing such equalization before proceeding to subsequent tests.

d. Test soldiers should be representative of those who will use the tentage in a user environment. Generally, they will be representative of the 5th through the 95th percentile in height, weight, and body configuration as described in the applicable portions of Military Standard 1472A, Human Engineering Design Criteria. In addition, some test soldiers should be left handed and some should wear eyeglasses.

3. Functional Suitability.

a. Objective. To evaluate the suitability of the test item to provide the degree of shelter required under conditions normally encountered in a tactical environment.

b. Method.

(1) The technical performance and safety characteristics of the test item will usually be determined from the results of engineering and laboratory tests conducted under precisely controlled and instrumented test conditions (refer to TOP 10-2-175, Tents and Shelters). However, during the expanded service test, the suitability of the test item will be determined under tactical field conditions and when employed by soldiers representative of the intended users.

(2) The functional aspects to be evaluated during the expanded service test are those pertaining to protection from environmental effects. Tents and shelters are expected to protect soldiers from

rain, sun, wind, dust, temperature extremes, insects and other environmental conditions. Specific criteria for test item functional characteristics will usually be stated in requirements documents.

(3) Tents and shelters will be tested under field conditions similar to those the item will encounter when used tactically. Based on the established criteria in requirements documents, field exercises appropriate for testing a particular test item may be selected from TOP 1-1-046, Field Combat Test Exercises. The tactical exercises should be designed to ensure all test item operational characteristics described in requirements documents or test directives are fully demonstrated.

(4) During the conduct of tactical field exercises, the test item will be erected, struck, and stowed, using test soldiers representative of those expected to use the test item in the field. Realistic combat tasks or activities appropriate for the condition being evaluated will be accomplished in a tactical environment. The frequency of test soldiers entering or leaving the test item, or the period of time they remain inside, should be commensurate with the normal requirements of the tactical situation. Any specific activities or time periods specified in the established requirements should be included in the test exercise.

(5) Tentage designed as living quarters should be tested by soldiers performing such activities as eating, sleeping, reading, washing, shaving, smoking, and other similar functions while inside the test item. When the test item is used as an operational area, such as a command post or communications center, the test soldiers should conduct activities which are normal for that type operation. Test soldiers should wear clothing and equipment appropriate for the situation and actions to be performed. During these operations the test item should be examined for any discomforts encountered by personnel or any interference with the activities being performed. For example, discomfort or interference might be caused by inadequate space to perform the required activity, by inadequate illumination, by an inability to operate communications equipment properly, by inadequate heating or ventilation systems, by too much noise, by insects, or by other phenomena related to functional characteristics. Data collection personnel should be as unobtrusive as practicable during these exercises. They must be able to fully observe all activities, yet not detract from the tactical realism of the test.

(6) For heating the space inside the test item, the appropriate heating equipment as established by TOE or other authority will be installed and operated in accordance with applicable procedures.

27 November 1972

(7) For test items with insect screening, either built-in or available as an accessory, the effectiveness of such screening will be evaluated. The test item will be erected in daytime in an area infested with flying insects. All insect netting will be emplaced and carefully secured. The side walls, ventilators, and doors will be opened for maximum ventilation as applicable for the design of the test item. Be sure there are no insects within the interior of the test item at the beginning of the test period. (Caution: Do not use a chemical spray to eliminate insects that may be inside, because such a procedure may invalidate subsequent results.) During darkness, with one or more (depending on the test item size) bright, white light sources burning within, test soldiers will perform normal activities inside the test item. Personnel should continue normal use of the doors for entrance and egress. The local Medical Service Corps (MSC) Vector Control Section should be contacted for assistance in the planning for and the conduct of this exercise, and in determining the extent of insect entrance.

(8) The field exercises should be conducted in areas that allow variations in type of terrain and vegetation in order to obtain test data for all conditions that would normally be expected for the test item. For example, test conditions should include varying degrees of flat and hilly terrain, and open fields and heavily wooded areas.

(9) Portions of the planned service testing should be conducted under adverse environmental conditions. The test and control items will be used and maintained during and/or immediately following exposure to naturally occurring adverse conditions such as dust, sand, rain, wind, darkness, mud, and extreme temperatures. Specific plans will be made to designate state of readiness conditions for test equipment and personnel to be on call to take advantage of adverse weather conditions that occur during testing. When naturally occurring adverse conditions are insufficient to satisfy requirements, field expedients may be used to simulate some of the desired conditions. Operational failures, malfunctions, and other occurrences affecting operation of the test item will be noted.

(10) When control items are provided, the test design should allow the collection of comparative data during functional tests.

c. Data Required.

(1) A narrative description of each tactical field exercise conducted, to include date, time, place, light conditions (daylight or darkness), and description (in general terms) of terrain and vegetation.

(2) A description of the test item function performed (troop living quarters, command post, aid station, communications center). A description of the duties or activities of the individual test soldiers during the operation should be included, if applicable.

(3) A description of any discomfort, difficulty, or injury attributable to the test item.

(4) Weather conditions, to include temperature, type and amount of precipitation, and wind speed and direction.

(5) A description of the clothing and equipment worn or carried by the test soldiers.

(6) A description of any failure, malfunction, or other occurrence affecting the functional suitability of the test item. Give enough details for a full understanding of the situation described. For example:

(a) For instances of penetration (by moisture, dust, insects), describe the exact location (if known) where penetration occurred, such as at seams, closures, junction point of test item with ground. Use sketches or diagram as necessary for clarity.

(b) Describe water leaks as due to fabric, seams, or wicking (capillarity).

(c) Define the intensity of water leakage as negligible (damp spots, barely noticeable), minor (droplets forming on the fabric or at seams and hanging there, with no movement of water), or major (water continually leaking and dropping off or running down the inner surface of the test item).

d. Analytical Plan. The test data for the test item's functional characteristics will be compared with those of the control item or with other established criteria. A subjective determination will be made as to the suitability of the test item for Army use.

9. Ease of Handling.

a. Objectives.

(1) To determine whether the test item meets the established criteria for ease of handling, time required for erecting, striking, and stowing, and for man-transportability of the test item or its components.

27 November 1972

(2) To evaluate the adequacy and accuracy of the operator (maintenance instructions for clarity and completeness of procedures for erection, operation, and striking of the test item.

b. Method.

(1) Test data for this subtest may be obtained during the conduct of functional suitability testing. Additional or separate exercises may be conducted, if necessary, to provide sufficient data for this subtest.

(2) The test item should be erected, struck, and stowed by test soldiers representative of those expected to use the test item in the field. Test soldiers should be equipped with fighting and existence loads appropriate for the tactical situation. The number of test soldiers used should be in accordance with established criteria found in the appropriate requirements documents. Test procedures should be accomplished under various conditions of terrain (flat, hilly), vegetation (open fields, wooded areas), time of day (daylight and darkness), and weather conditions. During all operations, light and noise discipline should be observed as appropriate for the tactical situation.

(3) Components of the test item should be hand carried by the number of men and for the distance prescribed by the established criteria.

c. Data Required.

(1) The mean time to erect the test item, computed for each test condition and number of soldiers used (see para b(a), above). The timed period will be from the arrival at the test site until the test item is ready for occupancy.

(2) The mean time required to strike and stow the test item on its transportation vehicle, computed for each test condition and crew size (see para b(2), above).

(3) A narrative description of each test exercise conducted, to include date, time, place, light conditions, weather, terrain, and vegetation.

(4) A description of man-transportable components, to include weight, dimensions, and configuration. The distance it was carried, and by how many men, should also be recorded.

(5) A description of any difficulties, discomfort, or injuries attributable to the test item.

(6) Any additional data having a bearing on the ease of handling the test item.

(7) The narrative data should be supplemented with photographs whenever appropriate.

d. Analytical Plan. The test item's observed handling characteristics (mean times required for erecting, striking, and stowing) and data pertaining to ease of handling and man-transporting the test item should be compared with those of the control item or with those prescribed in requirements documents to determine if applicable criteria have been met.

10. Security from Detection.

a. To determine the test item's susceptibility to detection, the procedures described in TOP 1-3-515, Security from Detection, should be accomplished. These may be accomplished concurrently with the conduct of functional suitability testing (para 5, above). Additional or separate exercises may be conducted, if necessary, to provide sufficient data for this subtest.

b. The test item should be erected and operated under various conditions of terrain, vegetation, and light conditions (including blackout at night). Observations should be made to determine if, and at what distances, the test item is easily detectable, and by what phenomena (color, configuration, illumination, etc).

c. Observations should also be made as to the adaptability of camouflage to the test item. Camouflage may be accomplished by using natural materials (vegetation, mud), camouflage netting, or other techniques.

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APPENDIX
REFERENCES

1. AR 70-10, Test and Evaluation During Research and Development.
2. National Bureau of Standards Handbook 91, Experimental Statistics.
3. TECR 70-23, Equipment Performance Reports.
4. TECR 70-24, Documenting Test Plans and Reports.
5. TECR 70-34, Risk Analysis for Suitability Reports.
6. TECR 385-6, Verification of Safety of Materiel During Testing.
7. TECR 700-1, Quality Assurance; Value Engineering.
8. TECR 750-15, Maintenance Evaluation During Testing.
9. TOP 1-1-012, Classification of Deficiencies and Shortcomings.
10. TOP 1-1-045, General Supplies and Equipment Testing.
11. TOP 1-1-046, Field Combat Test Exercises.
12. TOP 3-1-002, Confidence Intervals and Sample Size.
13. TOP 10-3-175, Tents and Shelters.
14. MIL STD 1472A, Human Engineering Design Criteria.

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